



Development of Intensity-Frequency-Duration (IFD) Information Across Australia


Janice Green
13 July 2009




Presentation Outline

- Current IFD estimates
- IFD Revision
 - Deliverables
 - Data
 - Sources
 - Quality controlling
 - Development of approach
 - Future work





Current IFDs – AR&R 87





Current IFDs – Adopted Approach

Aspect	ARR87
Data	BoM stations only
Record length	~ up to 1983; 7500 daily read > 30 years; 600 pluviographs > 6 years
Frequency analysis	Annual maximum series; method of moments; Log-Pearson Type III
Daily to sub-daily	Principal Component Analysis
Mapping	Subjective (meteorological analysis)
Frequency	ARIs 1 year to 100 year
Duration	5 minute to 72 hour (3 day)
Dissemination	Maps; HAS; CDIRS on-line
Climate change	Stationary climate assumed; climatic trends negligible effect on IFDs



Current IFDs – Feedback (complaints!)

- Absence of data from other agencies – particularly pluviograph stations.
 - Sydney Water data on Illawarra escarpment;
 - Melbourne Water thunderstorm data
 - Gold Coast City Council
 - ?
- Durations of < 5 mins for urban areas
- Incorrect mapping of data
- Subjectivity of interpretation of maps
- (Size of maps)
- Absence of consideration of climate change



IFD Revision

- Revision of IFDs identified by users of AR&R as the highest priority for revision
- Project being undertaken as part of overall revision of AR&R under auspices of EA
- Funding provided by Department of Climate Change for 2008/2009
- In-kind contribution from Water Division of BoM for 2008/2009
- Funding provided by Water Division for 2009/2010 and 2010/2011



Deliverables

- Deliverables by 31 August 2009
 - A quality controlled database of rainfall and pluviograph data collected nationally from all agencies.
 - An agreed detailed methodology for data analysis, necessary for development of IFD relationships for current and projected climate regimes.
 - Reports detailing these activities
- Deliverables by 30 June 2011
 - Revised IFD estimates across Australia available via AWRIS
 - Reports detailing these activities





Deliverables

- Deliverables by 31 August 2009
 - A quality controlled database of rainfall and pluviograph data collected nationally from all agencies.
 - An agreed detailed methodology for data analysis, necessary for development of IFD relationships for current and projected climate regimes.

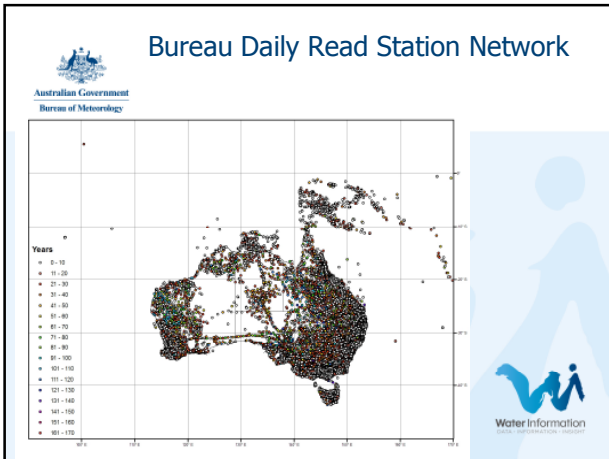


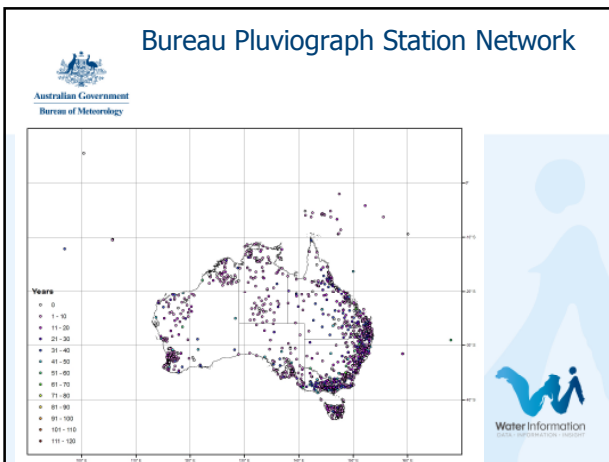


Data Sources

- Bureau of Meteorology Australian Data Archive for Meteorology (ADAM)
 - Contains 19711 daily read rainfall stations (both open & closed) for period from 1800 to 2008
 - Contain 1467 pluviograph stations – both DINES & TBRG
- Automated Local Evaluation in Real-Time (ALERT) stations
 - Historically data have been archived by each state using different formats and quality controlled to different degrees
 - Current project is establishing a central database of Flood Warning Data







Data Sources

- Since publication of ARR87, Bureau has received considerable criticism wrt exclusion of non-Bureau stations
- Incorporation of data from all agencies marries with Water Regulations 2008 & AWRIS project
- Water Regulations 2008, identified 260 'persons' who collect data and are required to provide it to Bureau

Water Information
DATA · INFORMATION · INSIGHT

Data Sources

- Category A – Lead Water Agencies
- Category B – Other Agencies
- Category C – Hydroelectricity Generators
- Category D – owners or operators of major storages
- Category E – rural water utilities
- Category F – urban water utilities
- Category G – CMAs and others
- Category H – providers of water information for flood forecasting and warning



Data Sources

- **Category A – Lead Water Agencies**
- Category B – Other Agencies
- **Category C – Hydroelectricity Generators**
- Category D – owners or operators of major storages
- Category E – rural water utilities
- **Category F – urban water utilities**
- Category G – CMAs and others
- Category H – providers of water information for flood forecasting and warning



Data Sources

- Other (non-electronic data)
 - Strategic Water Information Co-ordinators (SWICs) appointed for each state
 - Identification of data collectors – specifically asked to complete survey regarding daily rainfall & pluviograph data collectors including non-electronic format
 - Identification of historic (censored) data on large storm events that occurred but were not recorded at 'official' raingauges => 'peg bucket survey'
- Meta data
 - Location (lat & long)
 - Elevation
 - Clearance
 - Site plan





Quality Control

- Quality Monitoring System (QMS) currently being established by Bureau; automated system which flags suspect data for subsequent manual assessment
- For rainfall data the following automated tests are undertaken
 - Climate – compares value with upper and lower limits recorded at location
 - Domain – sanity checks value against possible / reasonable range
 - Barnes analysis – tests the value against weighted values recorded at all stations within a 200 km² radius (if > 2 stations)
 - Consistency tests – comparison of hourly observations with daily totals
 - Precipitation Multi Sensor Comparison – checks if data from a daily read raingauge is consistent with TBRG at same site
 - Precipitation Date Shift – compares a month of record with the corresponding month of record at neighbouring stations to assess if the entered timing is correct by shifting data at target site





Quality Control

- Additional tests developed as part of IFD Revision Project
 - Disaggregation of accumulated daily rainfall totals
 - Infilling of missing data
 - Identification of unflagged accumulated totals
 - Identification of time shifts
 - Checking of rainfall data against the Bureau Australian Water Availability Project (BAWAP) gridded data
 - Checking of missing pluviograph data against synoptic station data & Automatic Weather Station (AWS) data





Quality Control

- Manual checking of data identified as suspect
 - Verify record with NCC
 - Check ADAM & sites DB
 - Checking synoptic charts & satellite images
 - Checking raw data
- Development of a protocol (flow chart) for the manual checking



Deliverables

- Deliverables by 31 August 2009
 - A quality controlled database of rainfall and pluviograph data collected nationally from all agencies.
 - An agreed detailed methodology for data analysis, necessary for development of IFD relationships for current and projected climate regimes.



Development of approach

- Undertaken a review of approaches adopted previously including but not limited to:
 - AR&R87 approach
 - Pilot study undertaken by HAS
 - Flood Estimation Handbook Vol 2: Rainfall Frequency Estimation Institute of Hydrology, Wallingford, UK
 - Precipitation-Frequency Atlas of the United States, NOAA Atlas 14
 - The High Density Rainfall Design System: HIRDS, NIWA
 - Statistical downscaling work undertaken by CSIRO Climatic Extremes Research Group *Impact of Climate Variability & Climate Change on Rainfall Extremes in Western Sydney & Surrounding Areas* UPRCT
 - Other.....
- Review of relevant techniques developed both in Australia and overseas



Development of approach

Aspect	Revised IFDs
Data	Rainfall & pluviograph data from all collecting organisations
Record length	Up to December 2008*
Frequency analysis	Comparing - Annual maximum series and partial duration series; L-moments & Bayesian approach; Generalised Extreme Value Distribution (GEV); Generalised Logistic (GLO); Generalised Normal (GNO); Generalised Pareto (GPA); LPIII
Daily to sub-daily	PDS; Principal Component Analysis; PLSR; GLSR
Mapping	Objective computer-based approach (geo-regression; thin-plate smoothing) with meteorological over-sight
Frequency	ARIs 1 year to 200/500 year to 2000 year (CRCFORGE)
Duration	1 minute to 168 hours (7 day); monthly; seasonal
Dissemination	On-line via AWRIS; BYT
Climate change	IFD estimates provided for both current & projected climate regimes





Development of approach

Climate Change

- Incorporation and consideration of climate change signals
- Liaison with work to be undertaken by CSIRO
- Assessment of climate stationarity / non-stationarity
- Period of record to adopt





Future Work

- End August 2009
 - Quality controlled database
 - Agreed approach
- September 2009 – December 2010
 - Application of approach across Australia
 - Preliminary IFD estimates
- January 2011 – June 2011
 - Trialling of preliminary estimates & assessment of impact of changes





Thank you...

Janice Green
(03) 9669 4000
j.green@bom.gov.au
